

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-217636

(43)Date of publication of application : 10.08.2001

(51)Int.Cl.

H01Q 5/00

H01Q 1/32

(21)Application number : 2000-027947

(71)Applicant : HITACHI KOKUSAI ELECTRIC INC

(22)Date of filing : 04.02.2000

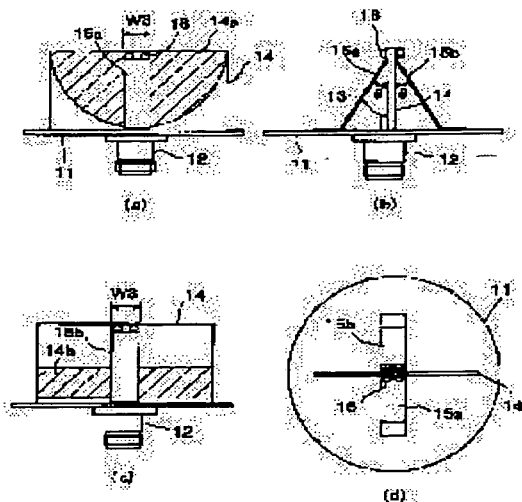
(72)Inventor : OZAWA MASAHIKO

(54) ANTENNA SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an antenna system which has wide band characteristics such that the antenna system can be used for plural frequency bands.

SOLUTION: A grounding plate 11 has a coaxial plug 12 mounted in its reverse center, and its center conductor 13 is projected on the top side of the grounding plate 11. In the upper center of the grounding plate 11, a rectangular printed board 14 is arranged vertically and held by metal plates 15a and 15b. The printed board 14 has a semicircular copper foil 14a vapor-deposited on one surface facing the center conductor 13 of the coaxial plug 12 and belt-like copper foil 14b vapor-deposited on the other surface closely to the grounding plate 11. The semicircular copper foil 14a is connected to the center conductor 13 nearby the top of the arc. Furthermore, the upper ends of metal plates 15a and 15b are fixed to both the sides of the upper end of the printed board 14 with a screw 16, and the semicircular copper foil 14a and the metal plates 15a and 15b are connected electrically. The metal plates 15a and 15b are so arranged that an angle θ with respect to the printed board 14 is 30 to 45°, and the lower part of the printed board is connected to the grounding plate 11.



- | | |
|-------------|----------------|
| 1...アース板 | 14a...半円状銅箔 |
| 2...直線導体 | 14b...帯状銅箔 |
| 13...中心導体 | 15a, 15b...金属板 |
| 14...プリント基板 | 16...ねじ |

LEGAL STATUS

[Date of request for examination] 17.09.2001

[Date of sending the examiner's decision of rejection] 02.09.2003

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3754258

[Date of registration] 22.12.2005

[Number of appeal against examiner's decision of rejection] 2003-19441

[Date of requesting appeal against examiner's decision of rejection] 02.10.2003

[Date of extinction of right]

(19)日本国特許庁 (J P)

(12) 公 開 特 許 公 報 (A)

(11)特許出願公開番号
特開2001-217636
(P2001-217636A)

(43)公開日 平成13年 8月10日 (2001. 8. 10)

(51)Int.Cl. ⁷	識別記号	F I	テマコード* (参考)
H 0 1 Q 5/00		H 0 1 Q 5/00	5 J 0 4 6
1/32		1/32	Z

審査請求 未請求 請求項の数 2 O L (全 5 頁)

(21)出願番号 特願2000-27947(P2000-27947)

(22)出願日 平成12年 2月 4日 (2000. 2. 4)

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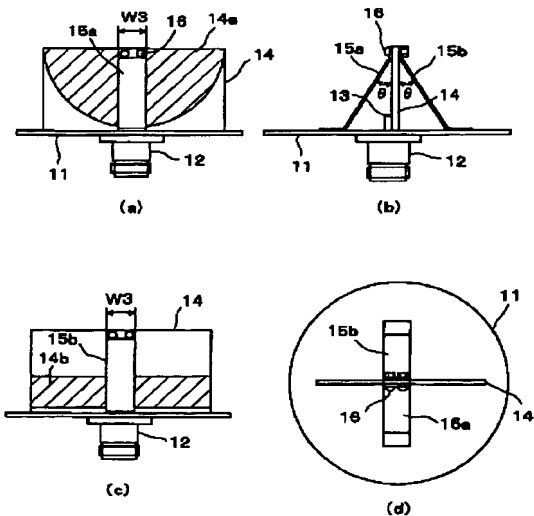
Fターム(参考) 5J046 AA04 AB06 MA00

(54)【発明の名称】 アンテナ装置

(57)【要約】

【課題】多周波数帯共用が可能な広帯域特性を有するアンテナ装置を提供する。

【解決手段】アース板11には、下側中央に同軸接栓12を装着し、その中心導体13をアース板11の上側に突出させる。また、アース板11の上側中央には、矩形状のプリント基板14を垂直に配置し、金属板15a、15bにより保持する。上記プリント基板14には、同軸接栓12の中心導体13と対向する一面に半円状銅箔14aを蒸着し、他面にアース板11に近接して帯状銅箔14bを蒸着する。半円状銅箔14aは、円弧の頂部近傍にを同軸接栓12の中心導体13に接続する。更に、プリント基板14の上端両側に金属板15a、15bの上端をねじ16により固定し、半円状銅箔14aと金属板15a、15bとの間を電氣的に接続する。金属板15a、15bは、プリント基板14とのなす角 θ が $30^{\circ} \sim 45^{\circ}$ となるように配置し、その下部をアース板11に接続する。



11...アース板	14a...半円状銅箔
12...同軸接栓	14b...帯状銅箔
13...中心導体	15a、15b...金属板
14...プリント基板	16...ねじ

【特許請求の範囲】

【請求項1】 アース板と、このアース板の下側に装着され、中心導体が該アース板の上側面から突出して設けられる同軸接栓と、上記アース板の上側中央部に垂直に設けられるプリント基板と、このプリント基板の一方の面に頂部が上記アース板側に位置するように形成された半円状銅箔と、この半円状銅箔の頂部と上記同軸接栓の中心導体とを電氣的に接続する手段と、上記プリント基板の他方の面に上記アース板側に位置するように形成された帯状銅箔と、上記プリント基板の両側に設けられ、上端が上記プリント基板上方中心部より半円状銅箔に電氣的に接続され、下端が上記アース板に電氣的に接続される金属板とを具備したことを特徴とするアンテナ装置。

【請求項2】 アース板と、このアース板の下側に装着され、中心導体が該アース板の上側面から突出して設けられる同軸接栓と、上記アース板の上側中央部に垂直に設けられるプリント基板と、このプリント基板の一方の面に頂部が上記アース板側に位置するように形成された半円状銅箔と、この半円状銅箔の頂部と上記同軸接栓の中心導体とを電氣的に接続する手段と、上記プリント基板の他方の面に上記アース板側に位置するように形成された帯状銅箔と、上記プリント基板の両側に設けられ、上端が上記プリント基板上方中心部より半円状銅箔に電氣的に接続され、下端が上記アース板に電氣的に接続される金属板と、上記アース板の上側に形成された構成部品を覆う絶縁カバーとを具備したことを特徴とするアンテナ装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、例えば移動体通信における車載用、屋内天井取付用等を使用される小形軽量で広帯域垂直偏波水平面無指向性のアンテナ装置に関する。

【0002】

【従来の技術】従来、移動体通信における小型軽量の車載用、屋内天井取付用の垂直偏波水平面無指向性アンテナは、例えばモノポール形、逆L形、逆F形等の方式を使用し、単一周波数帯で使用されている。

【0003】図7は、従来のモノポールアンテナの構成を示すものである。図7において、1はアース板で、このアース板1に同軸接栓2を図示下方側から取付け、その中心導体3をアース板1と絶縁し、上方へ約 $1/4\lambda$ 延長している。このとき中心導体3の詳細な寸法は、インピーダンス特性に依存するもので、それに基づいて決定される。

【0004】また、図8は、逆L形アンテナの構成を示すもので、アース板1に取付けた同軸接栓2の中心導体3を上方へ約 $1/4\lambda$ 延長し、その中心部から水平方向に 90° 折り曲げている。このとき中心導体3の詳細な

寸法は、インピーダンス特性に依存し決定される。

【0005】また、図9は、逆F形アンテナの構成を示すもので、アース板1に取付けた同軸接栓2の中心導体3を上方へ延長すると共に、その先端に逆L字状素子4の所定の位置を電氣的に接続する。上記逆L字状素子4は、中心導体3と並行している垂直部の下端をアース板1に電氣的に接続し、水平部を中心導体3の先端に接続している。このとき中心導体3と逆L字状素子4の位置関係及び詳細な寸法は、インピーダンス特性に依存し決定される。

【0006】上記従来技術によれば、単一周波数においては、良好な通信を行なうことができ、小形軽量のアンテナ装置を実現することができる。

【0007】

【発明が解決しようとする課題】しかしながら、上記従来のアンテナ装置では、何れの場合もインピーダンス特性は狭帯域で、例えば定在波比2.0以下では比帯域は数%~十数%にすぎず、多周波数帯共用は困難である。

【0008】近年では、多くの周波数帯が混在しており、例えば携帯電話においては、800MHz帯、1500MHz帯、次世代の2000MHz帯が混在しており、各周波数帯に対応するアンテナをそれぞれ設置する必要がある。しかし、設置スペースの都合や、美観の問題等から、制約を受けることがあり、アンテナを何種類も設置することが困難となる場合が生じてきている。また、上記設置場所の制約の問題から何種類もアンテナを設置できない場合は、限られた周波数帯しか利用できないという問題がある。

【0009】本発明は上記の課題を解決するためになされたもので、多周波数帯共用が可能な広帯域特性を有するアンテナ装置を提供することを目的とする。

【0010】

【課題を解決するための手段】第1の発明に係るアンテナ装置は、アース板と、このアース板の下側に装着され、中心導体が該アース板の上側面から突出して設けられる同軸接栓と、上記アース板の上側中央部に垂直に設けられるプリント基板と、このプリント基板の一方の面に頂部が上記アース板側に位置するように形成された半円状銅箔と、この半円状銅箔の頂部と上記同軸接栓の中心導体とを電氣的に接続する手段と、上記プリント基板の他方の面に上記アース板側に位置するように形成された帯状銅箔と、上記プリント基板の両側に設けられ、上端が上記プリント基板上方中心部より半円状銅箔に電氣的に接続され、下端が上記アース板に電氣的に接続される金属板とを具備したことを特徴とする。

【0011】第2の発明は、上記第1の発明に係るアンテナ装置において、アース板の上側に形成された構成部品を絶縁カバーにより覆ったことを特徴とする。

【0012】

【発明の実施の形態】以下、図面を参照して本発明の一

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実施形態を説明する。図1は、本発明の一実施形態に係る広帯域垂直偏波水平面無指向性のアンテナ装置の構成を示すもので、(a)は正面図、(b)は側面図、

(c)は背面図、(d)は上面図である。また、図2は、同実施形態におけるプリント基板に蒸着される半円状銅箔及び帯状銅箔の設定寸法を説明するためのもので、(a)は正面図、(b)は背面図である。

【0013】図1において、11はアース板で、例えば $0.5\lambda_0$ (λ_0 :中心波長)以上の直径を有している。上記アース板11には、下側中央に同軸接栓12を装着し、その中心導体13をアース板11の上側に突出させている。この場合、中心導体13は、アース板11と絶縁した状態に保持される。また、上記アース板11の上側中央には、矩形状のプリント基板14を垂直に配置し、金属板15a、15bにより保持している。

【0014】上記プリント基板14には、図1(a)に示すように同軸接栓12の中心導体13と対向する一方の面に半円状銅箔14aが蒸着されると共に、図1

(c)に示すように他方の面にアース板11に近接して帯状銅箔14bが蒸着される。上記半円状銅箔14aは、アース板11と絶縁されるよう適宜絶縁物により絶縁し、また、帯状銅箔14bは、他の金属とは絶縁状態となるように配置する。

【0015】上記プリント基板14の半円状銅箔14aは、図2(a)に示すように最大幅w1が $0.3\lambda_0 \sim 0.4\lambda_0$ 、高さh1が $0.15\lambda_0 \sim 0.2\lambda_0$ の範囲で設定され、円弧の頂部近傍(アース板11側)に同軸接栓12の中心導体13が電氣的に接続される。また、帯状銅箔14bは、図2(b)に示すように幅w2が $0.3\lambda_0 \sim 0.4\lambda_0$ 、高さh2が $0.05\lambda_0 \sim 0.1\lambda_0$ の範囲で設定される。

【0016】そして、図1(b)に示すようにプリント基板14の上端両側に金属板15a、15bの上端をねじ16により固定し、半円状銅箔14aと金属板15a、15bとの間を電氣的に接続している。この場合、金属板15a、15bは、プリント基板14とのなす角 θ が $30^\circ \sim 45^\circ$ となるように配置し、その下部をアース板11に電氣的に接続する。上記金属板15a、15bの幅w3は、 $0.05\lambda_0 \sim 0.2\lambda_0$ の範囲で設定される。なお、上記プリント基板14の半円状銅箔14aと金属板15a、15bとの電氣的接続は、ねじ止め以外の他の方法によっても良いことは勿論である。以上の詳細な寸法は、所望の周波数帯域、インピーダンス特性に依存し決定される。

【0017】更に、上記アース板11の上側には、図3に示すようにプリント基板14、及び金属板15a、15b等のアンテナ素子部分を保護するための絶縁カバー17が装着される。図3(a)は、絶縁カバー17を装着した状態を示すアンテナ装置の正面図、同図(b)は上面図である。

【0018】上記したようにプリント基板14に設けた半円状銅箔14aと金属板15a、15bの一端を電氣的に接続し、金属板15a、15bの他端をアース板11に接続する構造とすることにより、周波数特性におけるインピーダンスの変化が緩やかとなるアンテナ素子形状を構成し、更に帯状銅箔14bによるインピーダンス補正を行なって広帯域化を図ると共に、金属板15a、15bにより半円状銅箔14aからアース板11に電氣的に接続する折り返し構造とすることで、低姿勢化を図ることができる。

【0019】また、アンテナ素子部分を絶縁カバー17で覆うことにより、美観上優れた形状とすることができる。更に、本発明によるアンテナ装置は、プリント基板14、並びにプレス部品である金属板15a、15b等により簡易な構造で実現でき、低コスト化を図ることができる。

【0020】図4は、上記実施形態で示したアンテナ装置において、中心周波数 f_0 を1.8GHzとした場合の定在波比特性を示す図である。この特性図からも分かるように定在波比2.0以下における比帯域で約60%の広帯域特性が得られている。

【0021】また、図5は上記アンテナ装置の垂直偏波水平面指向性を示す図、図6は垂直偏波垂直面指向性を示す図で、垂直偏波水平面無指向性アンテナとして良好に動作している。

【0022】

【発明の効果】以上詳記したように本発明によれば、小形軽量、広帯域、垂直偏波水平面無指向性アンテナ装置を美観に優れた形状、低コストで実現することができる。また、使用可能な周波数帯を減らすことなく、アンテナ数を少なくでき、設置スペースの都合や、美観の問題等から制約を受けるような場所においても設置が可能となる。更に、アンテナ数が少なく済むことから、工事施工時の作業負担も軽減でき、高い経済性を得ることができる。

【図面の簡単な説明】

【図1】本発明の一実施形態に係るアンテナ装置を示し、(a)は絶縁カバーを外してアンテナ素子部分を示す正面図、(b)は側面図、(c)は背面図、(d)は上面図。

【図2】同実施形態において、プリント基板に蒸着される半円状銅箔及び帯状銅箔の設定寸法を説明するための図。

【図3】同実施形態におけるアンテナ装置の絶縁カバーを装着した状態を示したもので、(a)は正面図、(b)は上面図。

【図4】同実施形態における定在波比特性を示す図。

【図5】同実施形態における垂直偏波水平面指向性を示す図。

【図6】同実施形態における垂直偏波垂直面指向性を示す図。

す図。

【図7】従来のモノポールアンテナの構成を示す図。

【図8】従来の逆L形アンテナの構成を示す図。

【図9】従来の逆F形アンテナの構成を示す図。

【符号の説明】

11 アース板

12 同軸接栓

* 13 中心導体

14 プリント基板

14a 半円状銅箔

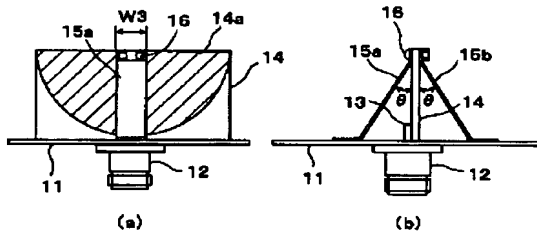
14b 帯状銅箔

15a、15b 金属板

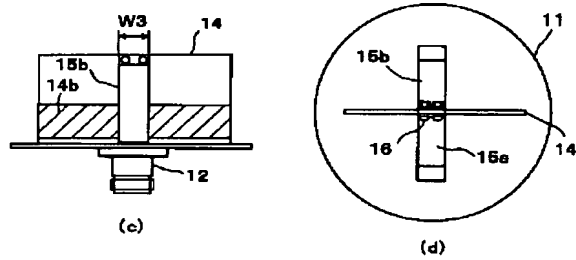
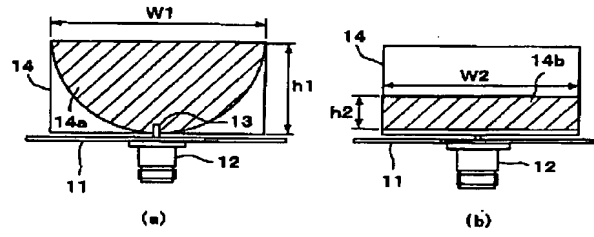
16 ねじ

* 17 絶縁カバー

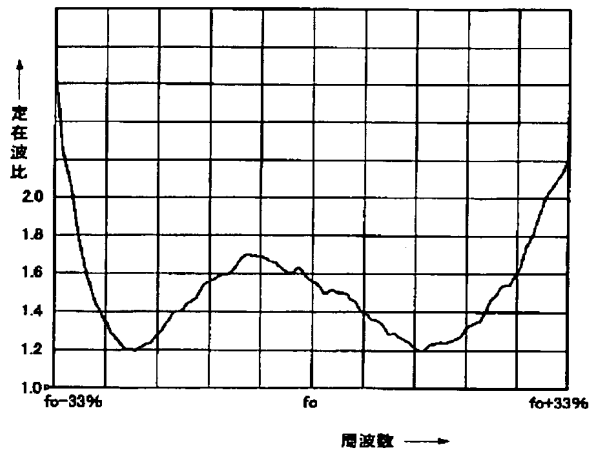
【図1】



【図2】

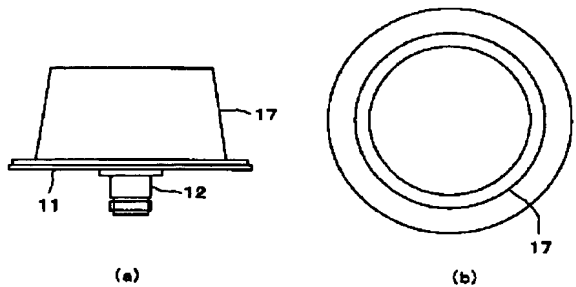


【図4】



11...アース板
12...同軸接栓
13...中心導体
14...プリント基板
14a...半円状銅箔
14b...帯状銅箔
15a、15b...金属板
16...ねじ

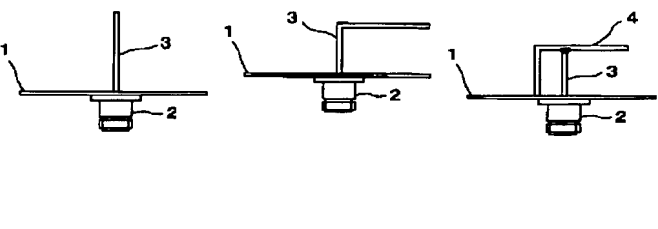
【図3】



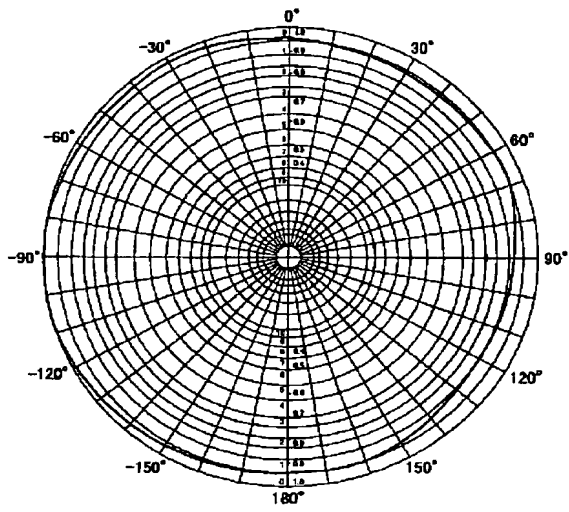
【図7】

【図8】

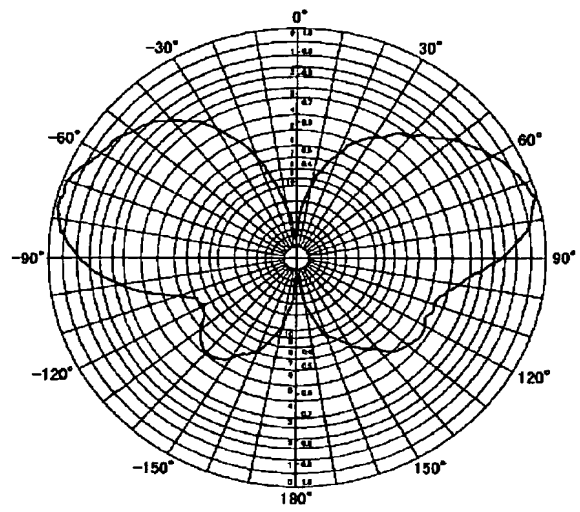
【図9】



【図5】



【図6】



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the antenna equipment light [small] and broadband vertically-polarized-wave horizontal plane indirectional used for the object for mount in mobile communications, and inside-of-a-house ceiling mounting.

[0002]

[Description of the Prior Art] Conventionally, methods, such as for example, a monopole form, inverted L, and reverse F forms, are used for the vertically-polarized-wave horizontal plane nondirectional antenna the small lightweight object for mount in mobile communications, and for inside-of-a-house ceiling mounting, and it is used with the single frequency band.

[0003] Drawing 7 shows the configuration of the conventional monopole antenna. In drawing 7, 1 is a grounded plate, it attaches the coaxial plug 2 in this grounded plate 1 from an illustration lower part side, insulates that central conductor 3 with a grounded plate 1, and is doing abbreviation 1 / 4 λ extension of it upwards. At this time, the detailed dimension of a central conductor 3 is determined based on it depending on an impedance characteristic.

[0004] Moreover, drawing 8 shows the configuration of an inverted L antenna, did upwards abbreviation 1 / 4 λ extension of the central conductor 3 of the coaxial plug 2 attached in the grounded plate 1, and has bent it from the core 90 degrees horizontally to it. At this time, the detailed dimension of a central conductor 3 is determined depending on an impedance characteristic.

[0005] Moreover, drawing 9 shows the configuration of a reverse F form antenna, and it connects the position of the inverse L-shaped component 4 at the tip electrically while it extends upwards the central conductor 3 of the coaxial plug 2 attached in the grounded plate 1. The above-mentioned inverse L-shaped component 4 connected electrically to the grounded plate 1 the lower limit of the vertical section which is concurrent with the central conductor 3, and has connected the horizontal level at the tip of a central conductor 3. At this time, the physical relationship and the detailed dimension of a central conductor 3 and the inverse L-shaped component 4 are determined depending on an impedance characteristic.

[0006] According to the above-mentioned conventional technique, in single frequency, a good communication link can be performed and small lightweight antenna equipment can be realized.

[0007]

[Problem(s) to be Solved by the Invention] However, with the above-mentioned conventional antenna equipment, an impedance characteristic is a narrow-band, a fractional bandwidth passes over neither of the cases to several % - about ten% by 2.0 or less standing-wave ratio, but the number band common use of multifrequencies is difficult.

[0008] Many frequency bands are intermingled, for example, the 800MHz band, the 1500MHz band, and the next-generation 2000MHz band are intermingled in a cellular phone, and it is necessary to install the antenna corresponding to each frequency band in recent years, respectively. However, the case where it becomes difficult from the convenience of an installation tooth space, the problem of a fine sight, etc. to receive constraint and to install an antenna many kinds is arising. Moreover, when an antenna cannot be installed how many kinds from the problem of constraint of the above-mentioned installation, there is a problem that only the limited frequency band can be used.

[0009] It was made in order that this invention might solve the above-mentioned technical problem,

and it aims at offering the antenna equipment which has the broadband property in which the number band common use of multifrequencies is possible.

[0010]

[Means for Solving the Problem] The coaxial plug in which this grounded plate and grounded plate bottom is equipped with the antenna equipment concerning the 1st invention, and a central conductor projects and is formed from the top side of this grounded plate, The printed circuit board prepared at right angles to the top center section of the above-mentioned grounded plate, and the semicircle-like copper foil formed so that a crowning might be located in one field of this printed circuit board at the above-mentioned grounded plate side, A means to connect electrically the crowning of this semicircle-like copper foil, and the central conductor of the above-mentioned coaxial plug, The band-like copper foil formed so that it might be located in the field of another side of the above-mentioned printed circuit board at the above-mentioned grounded plate side, It is characterized by providing the metal plate by which it is prepared in the both sides of the above-mentioned printed circuit board, upper limit is electrically connected to semicircle-like copper foil from the above-mentioned printed circuit board upper part core, and a lower limit is electrically connected to the above-mentioned grounded plate.

[0011] 2nd invention is characterized by covering the component part formed in the grounded plate bottom with insulating covering in the antenna equipment concerning the 1st above-mentioned invention.

[0012]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained with reference to a drawing. Drawing 1 shows the configuration of the antenna equipment of broadband vertically-polarized-wave horizontal plane indirectivity concerning 1 operation gestalt of this invention, and, for (a), a front view and (b) are [rear view and (d of a side elevation and (c))] plans. Moreover, drawing 2 is for explaining the setting dimension of the semicircle-like copper foil vapor-deposited by the printed circuit board in this operation gestalt, and band-like copper foil, (a) is a front view and (b) is rear view.

[0013] In drawing 1, 11 is a grounded plate, for example, it is $0.5\lambda_0$. It has the above (λ_0 : main wavelength) diameter. It equips with the coaxial plug 12 in the center of the bottom, and the central conductor 13 is made to project to the grounded plate 11 up side in the above-mentioned grounded plate 11. In this case, a central conductor 13 is held at the condition of having insulated with the grounded plate 11. Moreover, in the center of a top of the above-mentioned grounded plate 11, the rectangle-like printed circuit board 14 is arranged perpendicularly, and it holds with metal plates 15a and 15b in it.

[0014] As shown in drawing 1 (a), while while counters with the central conductor 13 of the coaxial plug 12 and semicircle-like copper foil 14a is vapor-deposited by the field, as shown in drawing 1 (c), a grounded plate 11 is approached in the field of another side, and band-like copper foil 14b is vapor-deposited by the above-mentioned printed circuit board 14. The above-mentioned semicircle-like copper foil 14a insulates with an insulating material suitably so that it may insulate with a grounded plate 11, and band-like copper foil 14b arranges other metals so that it may be in an insulating condition.

[0015] As shown in drawing 2 (a), for the maximum width w_1 , $0.3\lambda_0$ to $0.4\lambda_0$ and height h_1 are [semicircle-like copper foil 14a of the above-mentioned printed circuit board 14] $0.15\lambda_0$ to $0.2\lambda_0$. It is set up in the range and the central conductor 13 of the coaxial plug 12 is electrically connected near the crowning of radii (grounded plate 11 side). Moreover, as shown in drawing 2 (b), for width of face w_2 , $0.3\lambda_0$ to $0.4\lambda_0$ and height h_2 are [band-like copper foil 14b] $0.05\lambda_0$ to $0.1\lambda_0$. It is set up in the range.

[0016] And as shown in drawing 1 (b), the upper limit of metal plates 15a and 15b was ****ed on upper limit both sides of a printed circuit board 14, and it fixed by 16, and between semicircle-like copper foil 14a and metal plates 15a and 15b is connected electrically. In this case, metal plates 15a and 15b are arranged so that the angle θ with a printed circuit board 14 to make may become 30 degrees - 45 degrees, and they connect that lower part to a grounded plate 11 electrically. The width of face w_3 of the above-mentioned metal plates 15a and 15b is $0.05\lambda_0$ to $0.2\lambda_0$. It is set up in the range. In addition, the electrical installation of semicircle-like copper foil 14a of the above-

mentioned printed circuit board 14 and metal plates 15a and 15b is ****ed, and that of it being good by other approaches other than a stop is natural. The above detailed dimension is determined depending on a desired frequency band and an impedance characteristic.

[0017] Furthermore, the above-mentioned grounded plate 11 bottom is equipped with the insulating covering 17 for protecting antenna element parts, such as a printed circuit board 14 and metal plates 15a and 15b, as shown in drawing 3. The front view of the antenna equipment in which the condition that drawing 3 (a) equipped with the insulating covering 17 is shown, and this drawing (b) are plans.

[0018] By connecting electrically the end of metal plates 15a and 15b with semicircle-like copper foil 14a prepared in the printed circuit board 14, as described above, and making the other end of metal plates 15a and 15b into the structure linked to a grounded plate 11 While constituting the antenna element configuration from which change of the impedance in frequency characteristics becomes loose, performing impedance amendment by band-like copper foil 14b further and attaining broadband-ization Low profile-ization can be attained by considering as the clinch structure electrically connected to a grounded plate 11 from semicircle-like copper foil 14a with metal plates 15a and 15b.

[0019] Moreover, it can consider as the configuration where it excelled on the fine sight, by covering an antenna element part with the insulating covering 17. Furthermore, the metal plates 15a and 15b which are pressings can realize with simple structure in a printed circuit board 14 and a list, and the antenna equipment by this invention can attain low cost-ization in them.

[0020] It sets to the antenna equipment shown with the above-mentioned operation gestalt, and drawing 4 is center frequency f_0 . It is drawing showing the standing-wave ratio property at the time of being referred to as 1.8GHz. As shown also in this property Fig., about 60% of broadband property is acquired by the fractional bandwidth in 2.0 or less standing-wave ratio.

[0021] Moreover, drawing in which drawing 5 shows the vertically-polarized-wave horizontal plane directivity of the above-mentioned antenna equipment, and drawing 6 are drawings showing vertically-polarized-wave vertical plane directivity, and it is operating good as a vertically-polarized-wave horizontal plane nondirectional antenna.

[0022]

[Effect of the Invention] As a full account was given above, according to this invention, small lightweight, a broadband, and vertically-polarized-wave horizontal plane nondirectional antenna equipment are realizable by a configuration and low cost excellent in the fine sight. Moreover, without reducing an usable frequency band, the number of antennas can be lessened and installation becomes possible also in a location which receives constraint from the convenience of an installation tooth space, the problem of a fine sight, etc. Furthermore, since there are few antennas and it ends, the activity burden at the time of construction construction can also be mitigated, and high economical efficiency can be acquired.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] A grounded plate and the coaxial plug in which this grounded plate bottom is equipped, and a central conductor projects and is formed from the top side of this grounded plate, The printed circuit board prepared at right angles to the top center section of the above-mentioned grounded plate, and the semicircle-like copper foil formed so that a crowning might be located in one field of this printed circuit board at the above-mentioned grounded plate side, A means to connect electrically the crowning of this semicircle-like copper foil, and the central conductor of the above-mentioned coaxial plug, The band-like copper foil formed so that it might be located in the field of another side of the above-mentioned printed circuit board at the above-mentioned grounded plate side, Antenna equipment with which it is prepared in the both sides of the above-mentioned printed circuit board, and upper limit is characterized by providing the metal plate by which connects with semicircle-like copper foil electrically from the above-mentioned printed circuit board upper part core, and a lower limit is electrically connected to the above-mentioned grounded plate.

[Claim 2] A grounded plate and the coaxial plug in which this grounded plate bottom is equipped, and a central conductor projects and is formed from the top side of this grounded plate, The printed circuit board prepared at right angles to the top center section of the above-mentioned grounded plate, and the semicircle-like copper foil formed so that a crowning might be located in one field of this printed circuit board at the above-mentioned grounded plate side, A means to connect electrically the crowning of this semicircle-like copper foil, and the central conductor of the above-mentioned coaxial plug, The band-like copper foil formed so that it might be located in the field of another side of the above-mentioned printed circuit board at the above-mentioned grounded plate side, The metal plate by which it is prepared in the both sides of the above-mentioned printed circuit board, upper limit is electrically connected to semicircle-like copper foil from the above-mentioned printed circuit board upper part core, and a lower limit is electrically connected to the above-mentioned grounded plate, Antenna equipment characterized by providing wrap insulation covering for the component part formed in the above-mentioned grounded plate bottom.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] For a side elevation and (c), rear view and (d) are [the front view in which (a's) removing insulating covering and showing an antenna element part by showing the antenna equipment concerning 1 operation gestalt of this invention, and (b)] a plan.

[Drawing 2] Drawing for explaining the setting dimension of the semicircle-like copper foil vapor-deposited by the printed circuit board and band-like copper foil in this operation gestalt.

[Drawing 3] It is what showed the condition of having equipped with insulating covering of the antenna equipment in this operation gestalt, and for (a), it is a front view and (b) is a plan.

[Drawing 4] Drawing showing the standing-wave ratio property in this operation gestalt.

[Drawing 5] Drawing showing the vertically-polarized-wave horizontal plane directivity in this operation gestalt.

[Drawing 6] Drawing showing the vertically-polarized-wave vertical plane directivity in this operation gestalt.

[Drawing 7] Drawing showing the configuration of the conventional monopole antenna.

[Drawing 8] Drawing showing the configuration of the conventional inverted L antenna.

[Drawing 9] Drawing showing the configuration of the conventional reverse F form antenna.

[Description of Notations]

11 Grounded Plate

12 Coaxial Plug

13 Central Conductor

14 Printed Circuit Board

14a Semicircle-like copper foil

14b Band-like copper foil

15a, 15b Metal plate

16 Screw Thread

17 Insulating Covering

[Translation done.]